Z mass cut removal

Top Dilepton Meeting

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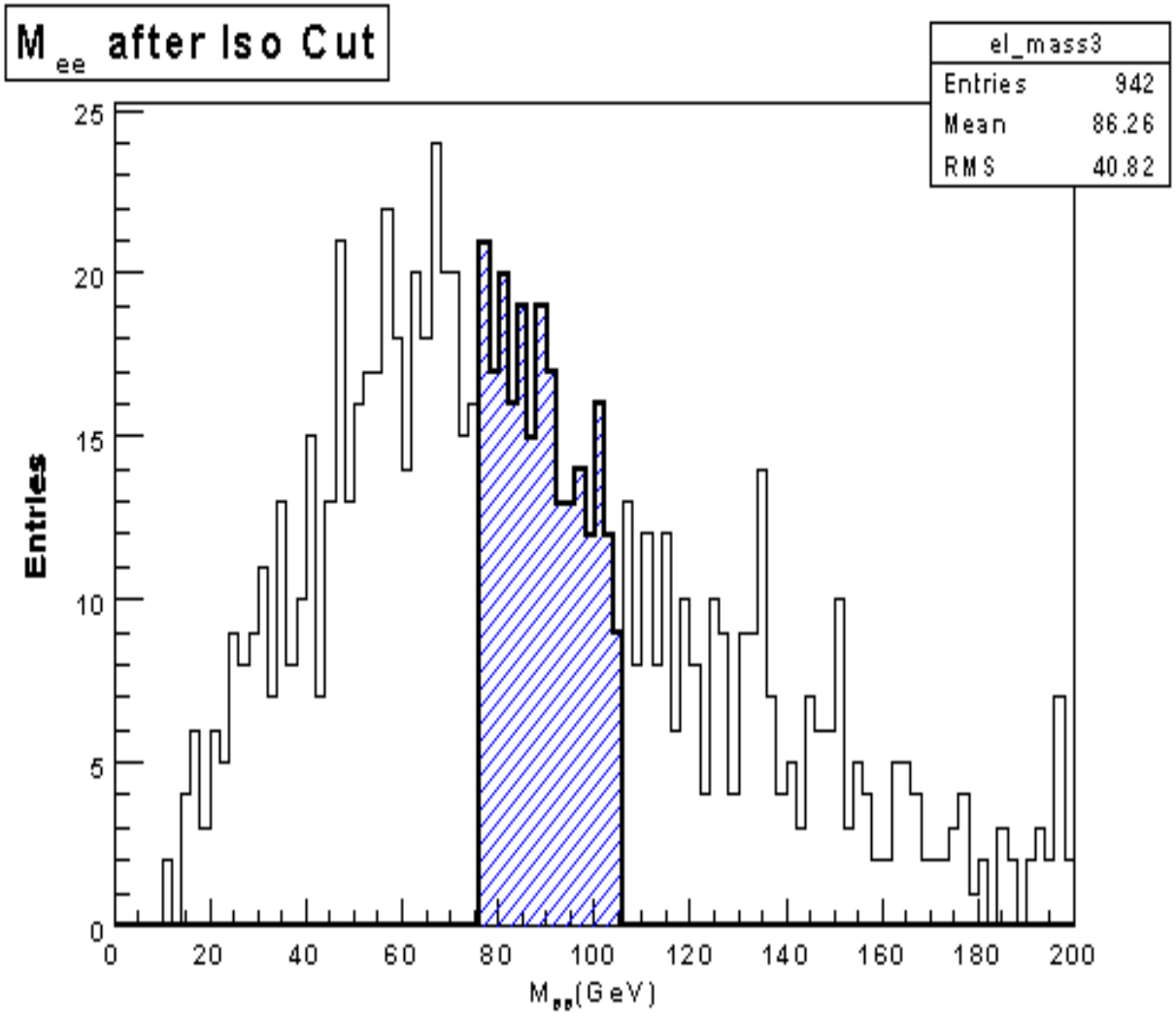
Mircea Coca

with U of Rochester Group

(Eva H., Andy H., Ricardo E., Andrew I., Paul T.)

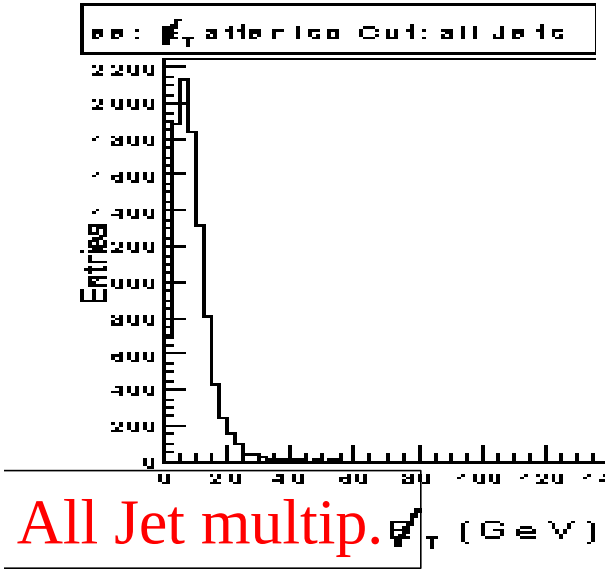
ttbar: M_{ee} invariant mass



- 24 % of ee or μμ events fall inside mass window
- Overall:

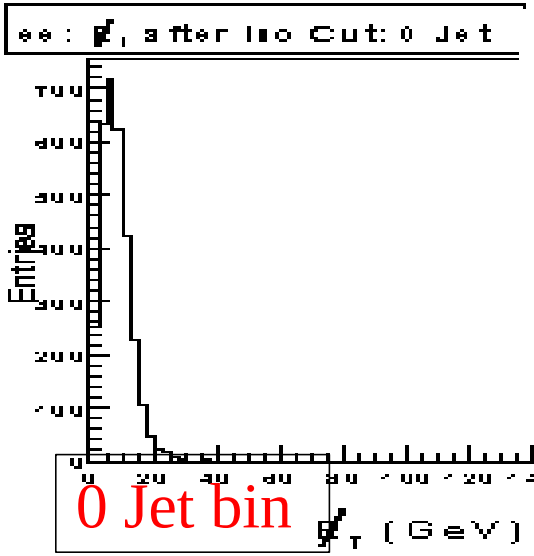
  12 % loss in the acceptance
- How to recover part of this loss?

How we get MET in a Z->ee event?
Met vs jet multiplicities



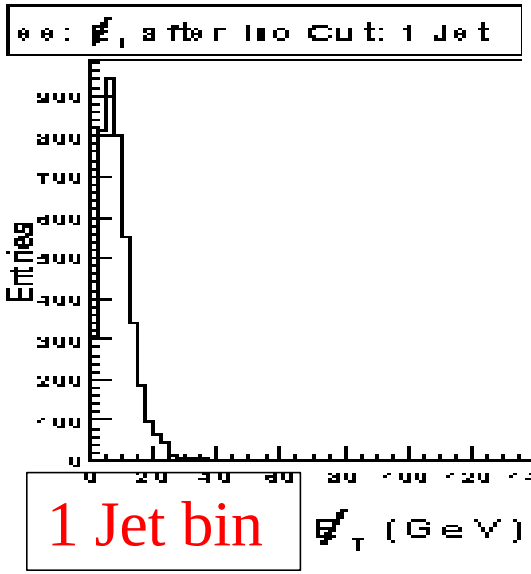
Mean: 8.9
RMS: 6.4

All Jet multip.



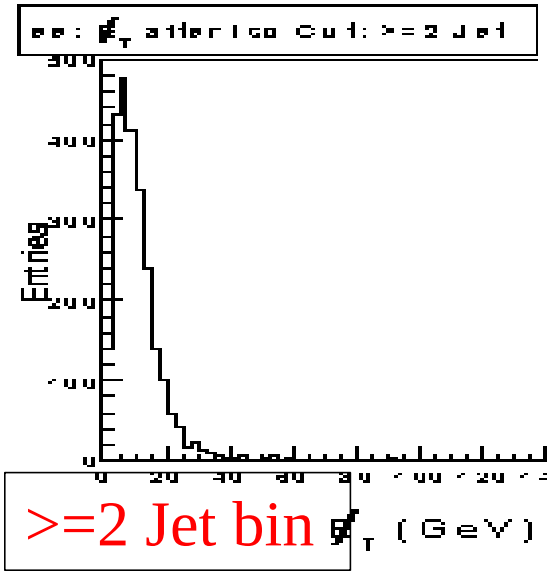
Mean: 7.8
RMS: 4.4

0 Jet bin



Mean: 8.6
RMS: 6.9

1 Jet bin



Mean: 10.4
RMS: 8.7

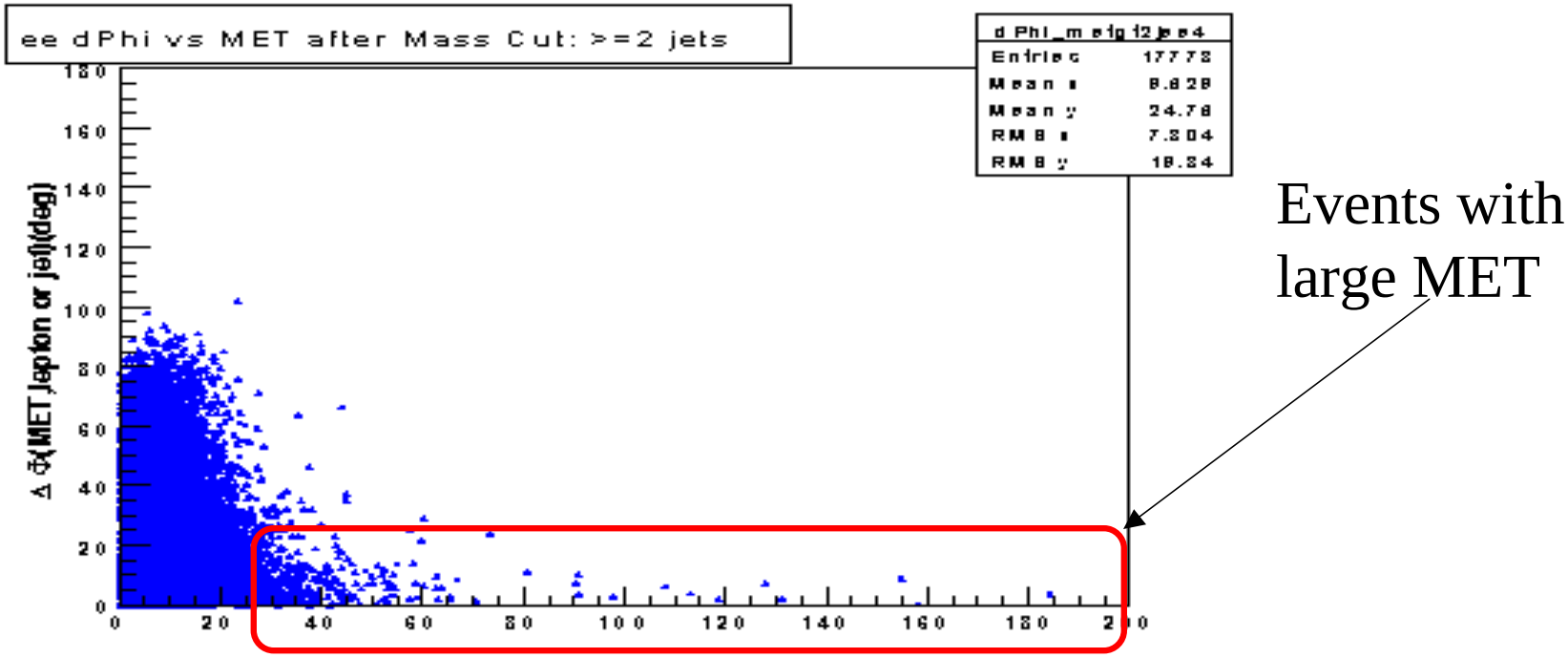
>=2 Jet bin

MET degrades as #jets increases

- Electrons are required to be fiducial, so typically they are very well measured (brem ?)
- Our calorimeter has many cracks which are perfect place for jet fragments to escape

  1) MET tends to be close to a jet

  2) the nearest jet from MET should be also near a crack



Making up statistics

- Because ee and μμ distributions agree very well (see Winter plots) I will look in ee channel only
- To study new cuts and take out any possible biases I look at distributions of events passing all the cuts (except OS)
- Not enough statistics (at most 25 events using alpgen sample)-> include electrons with $\eta < 2.0$ and looser id cuts ->these events fall in the mass window ->well reconstructed electrons-> 105 events (alpgen Z(ee)+2p atop23)

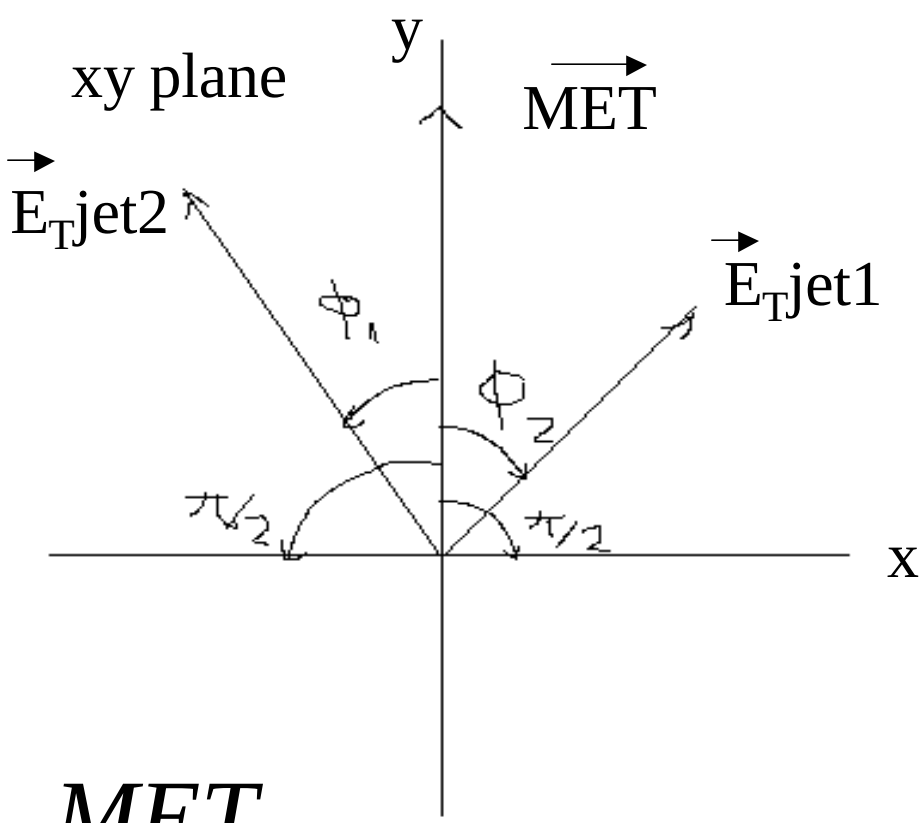
Variable investigated

- Missing energy significance (CDF 3387)
- Jet significance (CDF 3387)
- Angle between di-electrons (xy plane)
- Tighter mass cuts
- Tighter MET inside Z mass window (a la D0)

  $\Delta\phi$(di-jets, di-leptons)

Jet significance (or “met insignificance”)

- Assuming that MET is due to undermeasured jets, we expect that higher jet E_T, higher jet fluctuation->larger MET.
- To quantify the ratio between MET and jet activity along MET direction define:

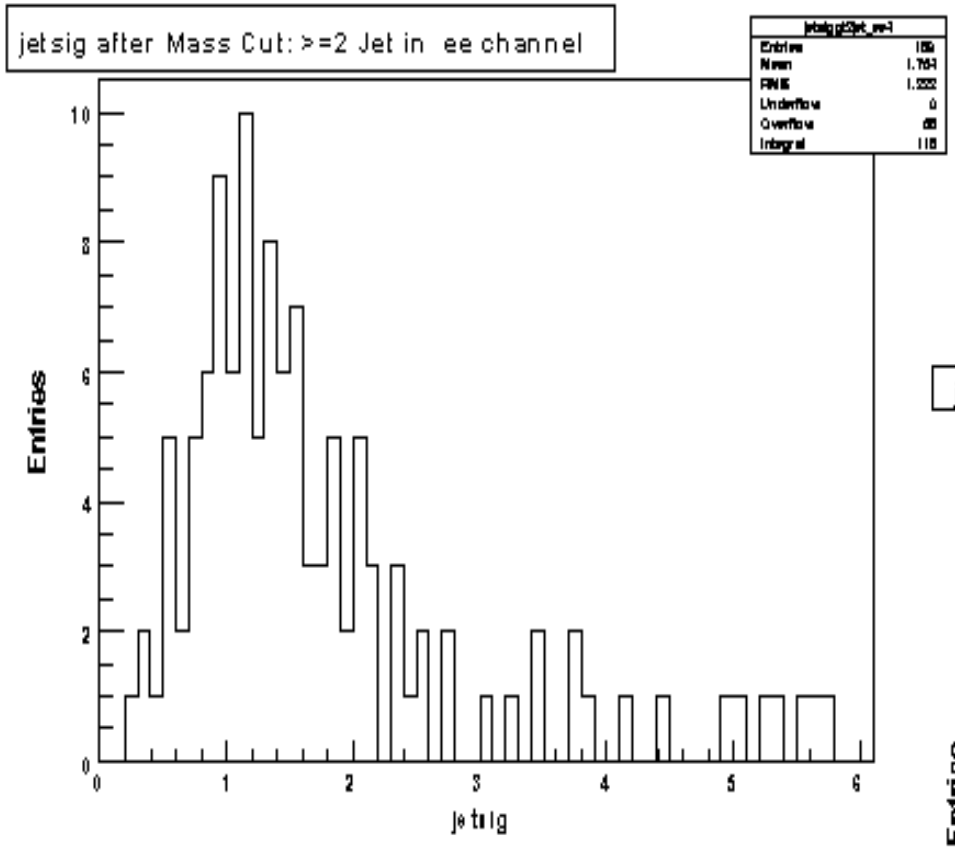


$$jetsig = \frac{MET}{\sqrt{\sum_{|\Delta f(met,jet)<90|} (\vec{E}_T\, jet \cdot \overrightarrow{MET})}}$$

Just a reminder…

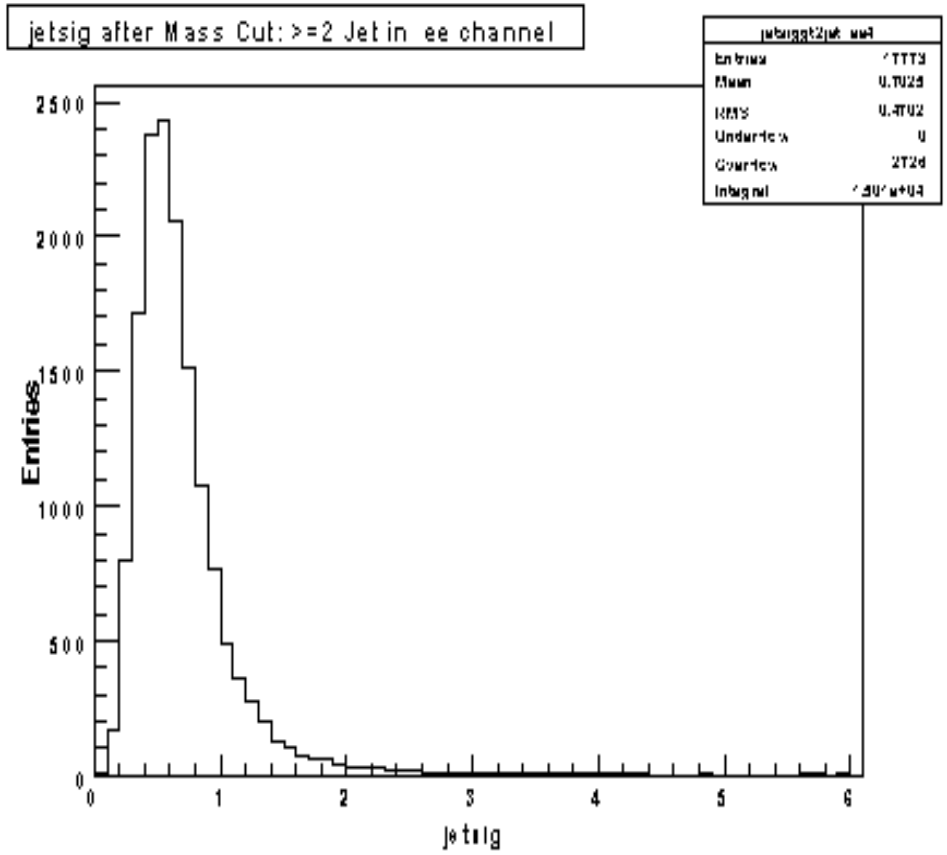
- We decided for the Summer to correct the jets for level 5 (assuming one primary vertex per event, so no multiple interactions correction) E_T >15 GeV and $|\eta| < 2.5$ -->"tight" jets
- The propagate the effect of corrections into the MET, H_T
- So we consider only tight jets for the jet significance definition

Jet sig for events: M_{ee} (76, 106) GeV, >=2jets

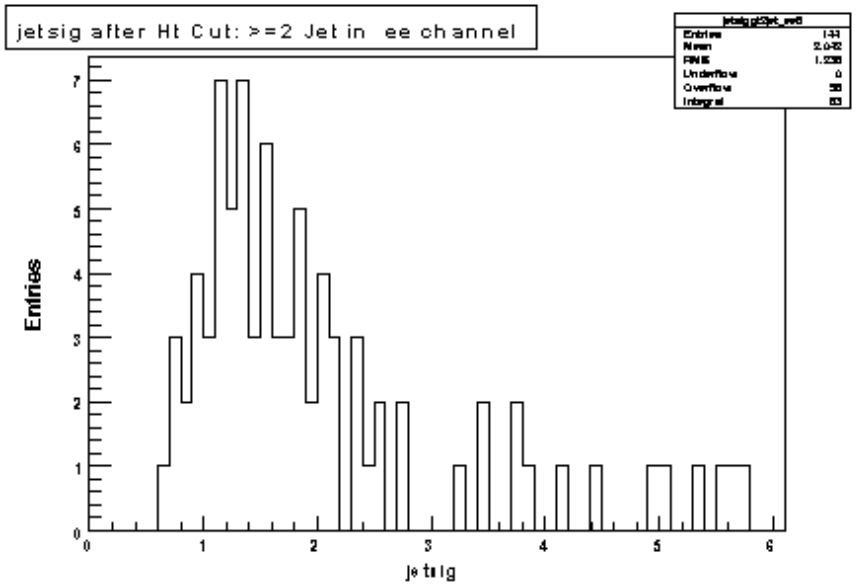


ttbar MC:
Mean: 1.76
RMS: 1.22
36% of events have jetsig > 6

Z(ee) MC:
Mean: 0.70
RMS: 0.47
15% of events have jetsig > 6

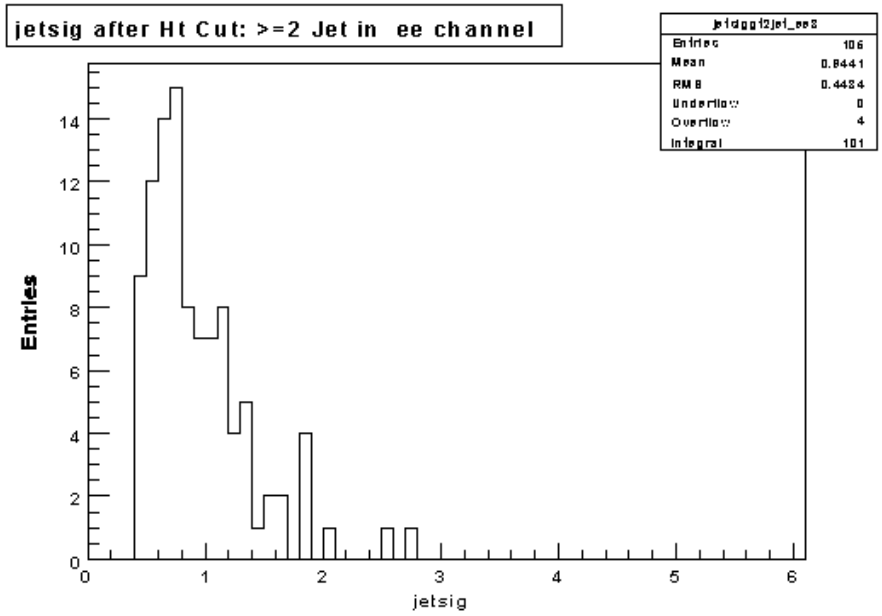


After all the cuts…



Z(ee) MC:
105 events
Mean: 0.94
RMS: 0.44
4% with jetsig > 6
(irreducible back)

ttbar MC:
144 events
Mean: 2.04
RMS: 1.24
53 % with jetsig >3
(real MET)



Jet Sig cut efficiencies

Jet Significance in alpgen $Z \rightarrow e^+e^- + 2p$ vs $t\bar{t}$		
JetSig cut	atop23 (# evts passing) efficiency(%) # events before the cut: 105	ttop2i (ev passing) efficiency(%) # events before the cut: 144
≥ 1.2	(33) 31.43 ± 4.53	(131) 90.97 ± 2.39
≥ 1.4	(21) 20.0 ± 3.90	(119) 82.64 ± 3.16
≥ 1.6	(15) 14.3 ± 3.41	(109) 75.70 ± 3.57
≥ 1.8	(11) 10.5 ± 2.99	(100) 69.44 ± 3.84
≥ 2.0	(7) 6.6 ± 2.43	(92) 63.89 ± 4.00

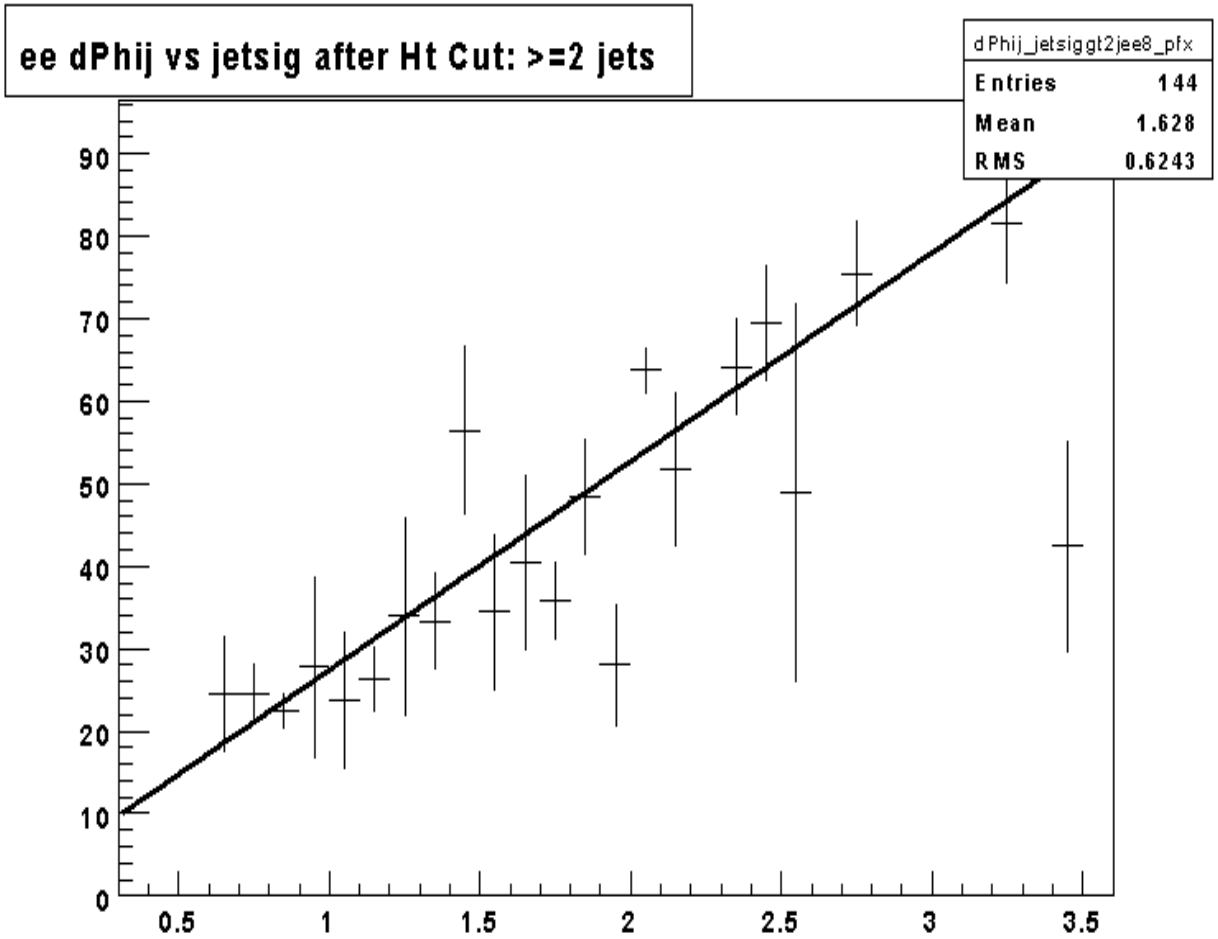
* The MET is corrected for level by, but I cut on level 3 corrected jets

$\Delta\phi$(MET, jet) cut efficiencies

$\Delta\phi(\not\!\!E_T$ jet) vs $\not\!\!E_T$ in alpgen $Z \to e^+e^- + 2p$ vs $t\bar{t}$		
$\Delta\phi(\not\!\!E_T$ jet) cut	alop23 (# evts passing) efficiency(%) # events before the cut: 105	tlop2i (ev passing) efficiency(%) # events before the cut: 144
≥ 5	(86) 81.9 $\pm$ 3.75	(137) 95.14 $\pm$ 1.79
≥ 10	(71) 67.6 $\pm$ 4.56	(128) 88.88 $\pm$ 2.62
≥ 15	(61) 58.1 $\pm$ 4.81	(121) 84.03 $\pm$ 3.05
≥ 20		(111) 77.08 $\pm$ 3.5

Cutting on jetsig = cutting on $\Delta\phi$(MET, jet) for ttbar

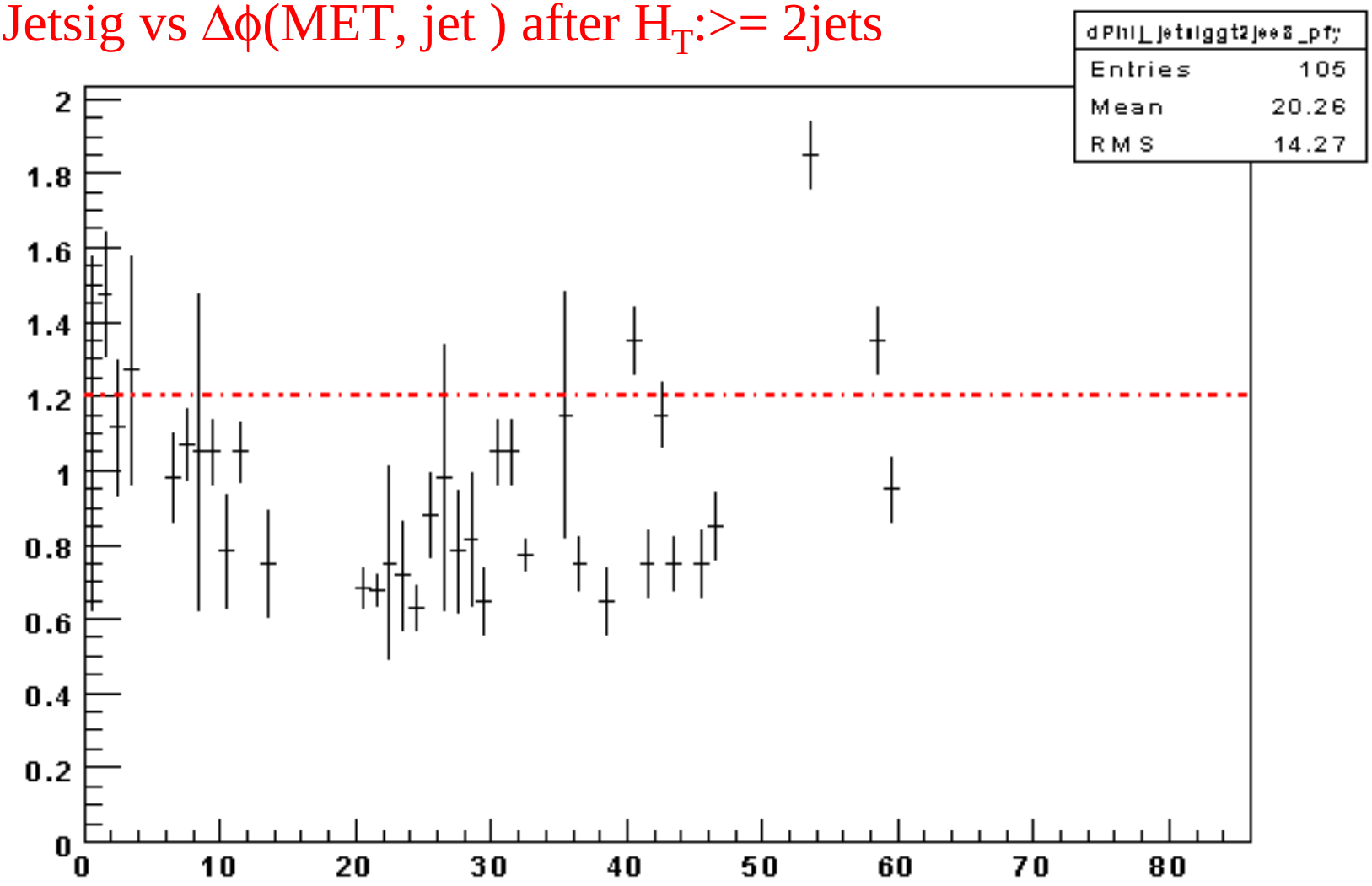
- For ttbar I expect that jetsig is correlated with the $\Delta\phi$ angle between met and nearest jet
- Why not look into this ?



ttbar MC

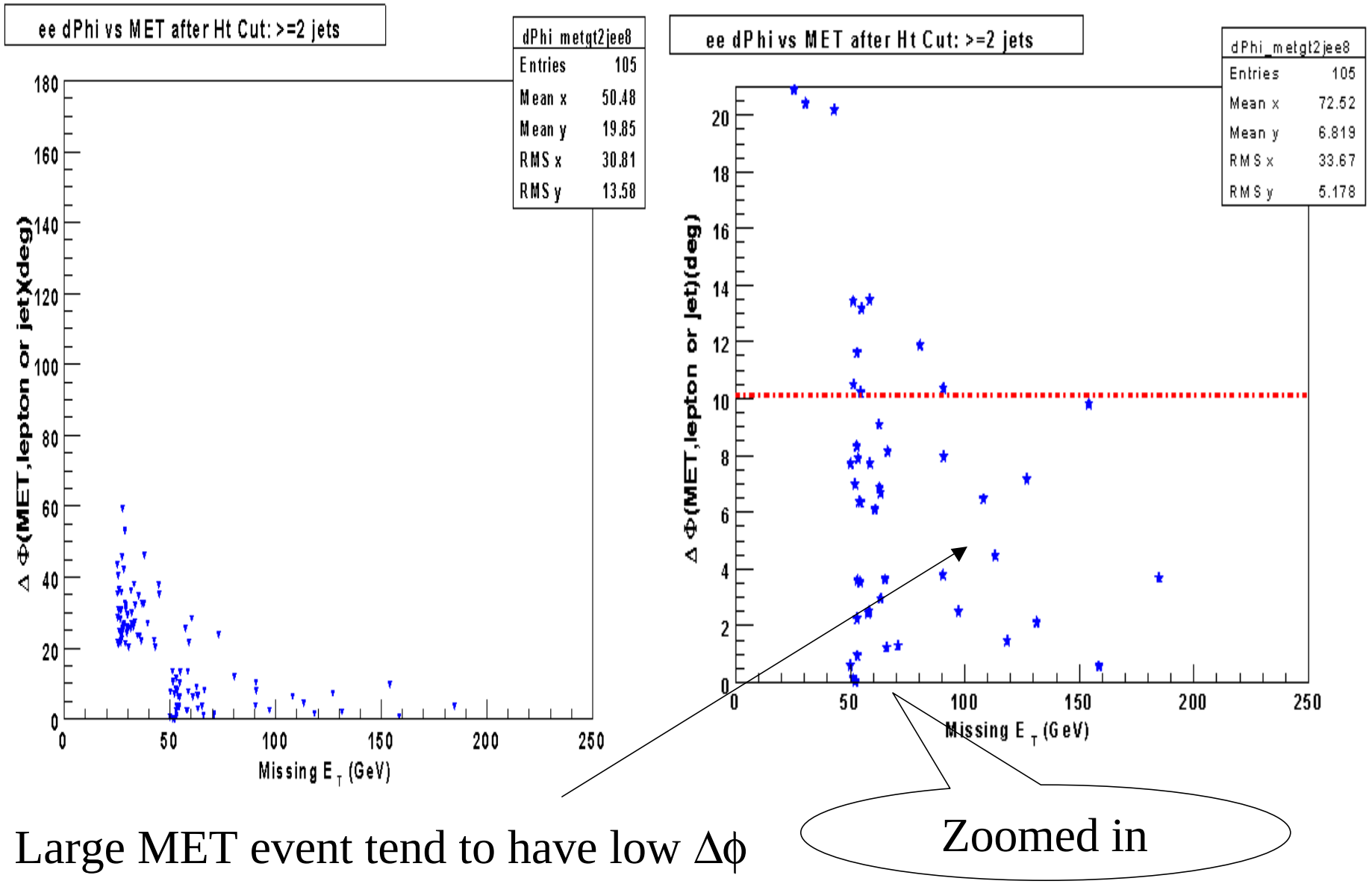
For Z(ee) there is no correlation…

ee: Jetsig vs $\Delta\phi$(MET, jet) after H_T:>= 2jets



$\Delta\phi$(MET, nearest jet)

Δϕ(MET, jet) for Z(ee) after all cuts



Large MET event tend to have low Δϕ

Zoomed in

$\Delta\phi$(MET, jet) vs jetsig

$\Delta\phi(\not\!\!E_T$, jet) vs jetsig in alpgen $Z \to e^+e^- + 2p$ vs $t\bar{t}$

($\Delta\phi(\not\!\!E_T$, jet), jetsig) cut	atop23 (# evts passing) efficiency(%) # events before the cut: 105	ttop2i (ev passing) efficiency(%) # events before the cut: 144
($\geq$1.0,$\geq$ 10)	(32) 28.32 $\pm$ 4.24	(132) 91.7 $\pm$ 2.30
($\geq$1.1,$\geq$ 10)	(29) 25.66 $\pm$ 4.11	(130) 90.3 $\pm$ 2.47
($\geq$1.2,$\geq$ 10)	(24) 21.24 $\pm$ 3.85	(126) 87.5 $\pm$ 2.75
($\geq$1.3,$\geq$ 10)	(24) 21.24 $\pm$ 3.85	(126) 87.5 $\pm$ 2.75
($\geq$1.4,$\geq$ 10)	(17) 15.04 $\pm$ 3.36	(119) 82.64 $\pm$ 3.16
($\geq$1.2 ,$\geq$ 5)	(29) 25.66 $\pm$ 4.11	(127) 88.20 $\pm$ 2.69

~10-15% loss

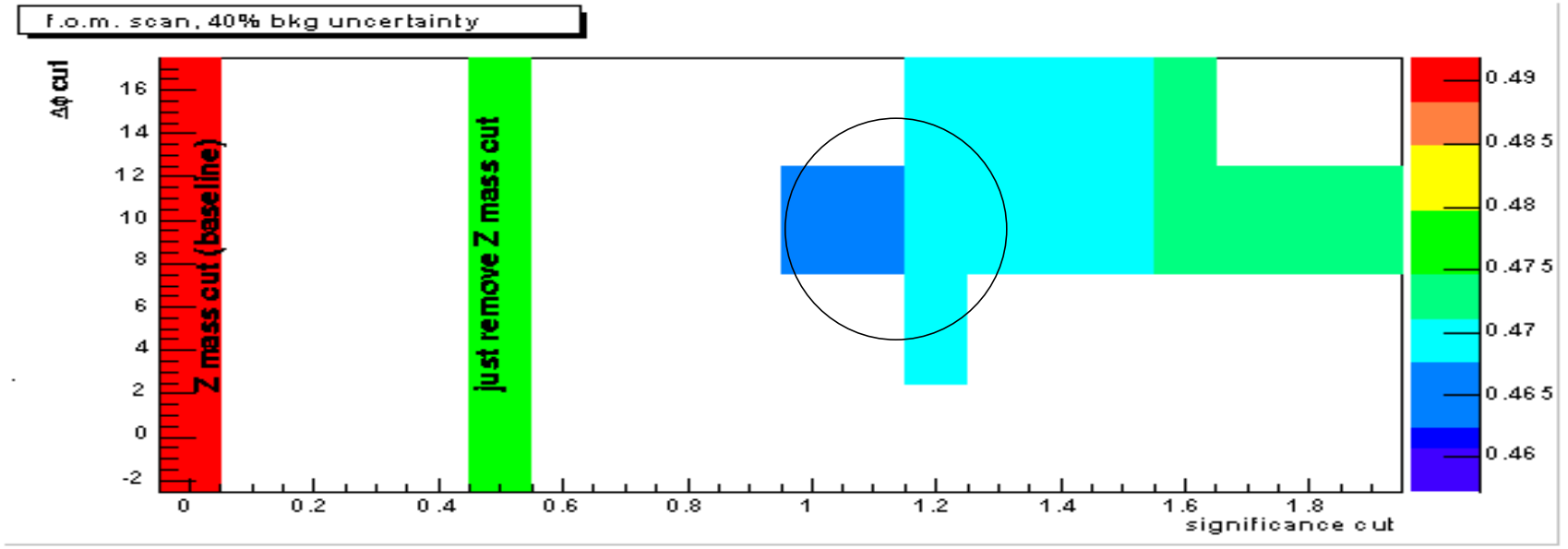
~80% rejection

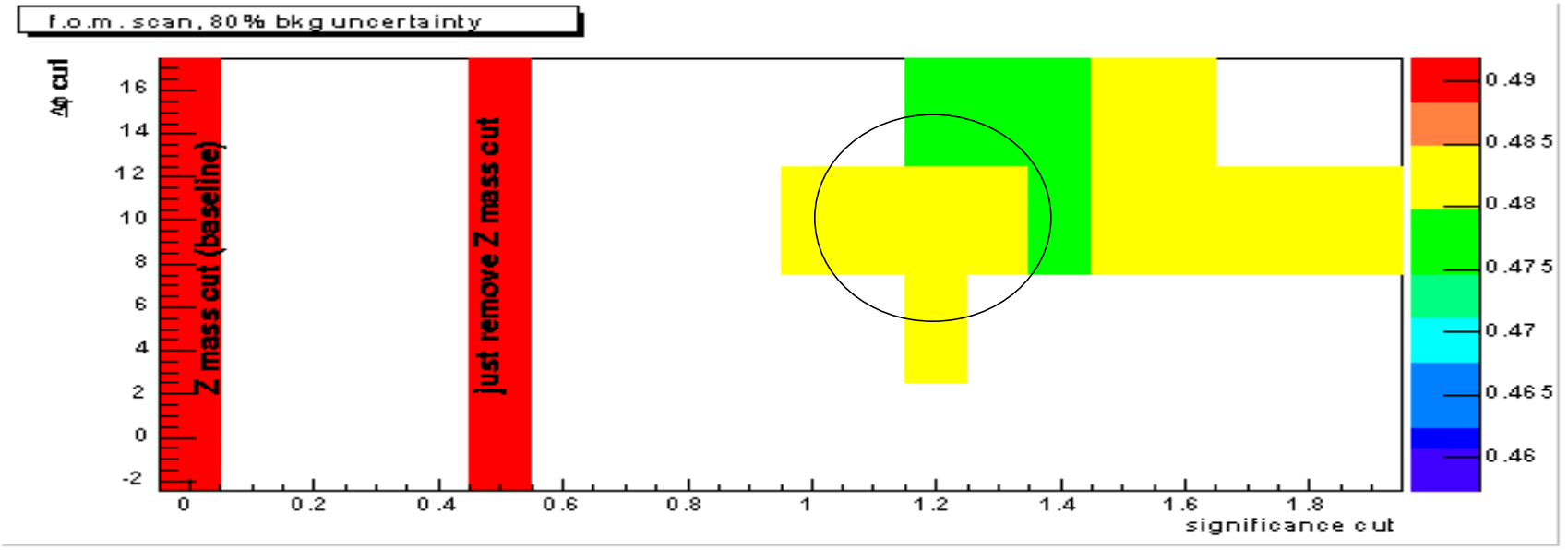
* The latest corrections are applied here…

Which is the best choice ?

- What is the background we expect in ee mass window, in 100 pb^{-1}, for jetsig >1.2, $\Delta\phi$(MET, jet) > 10?
  - ttop2i: 0.226 ± 0.018 events
  - ztop2e(Pythia Z(ee)): 0.104 ± 0.021 events (I used $N_{zee+2j(Pythia)}$ * eff(alpgen)
  - ztop2e(poor statistics): 0.04±0.04 events
  - data(Winter): $N_{zee+2jets(data)}$ * eff(alpgen) : 0.07 +/- 0.01 events
  - S/B~ 2 -> 3 just in the mass window

Relative uncertainty on the xsec (fom)





So let's replace the Z mass cut with…

- if(#jets>=1 with $|\Delta\phi(\text{met,jet}) < 90|$) then Jet Significance > 1.2

  &&

- $\Delta\phi$(MET,nearest jet) > 10 degrees
- Still I want to have the freedom to fine tune this cut with the full categories in place (in few days, once Chris,I and everyone agree on the acceptance numbers…)
- A preliminary version of a cdfnote is circulated around and I will post it soon…